

COMMUNICATION SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

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5 This application is based upon and claims the
benefit of priority from the prior Japanese Patent
Application No. 11-340490, filed November 30, 1999,
the entire contents of which are incorporated herein
by reference.

BACKGROUND OF THE INVENTION

10 The present invention relates to a communication
system for making communication using videos, sounds,
and electronic data, wherein a band range of the
transmission line is multiplexed by means of multiplex
techniques such as frequency multiplex, time multiplex,
15 and the like.

Normally, in case of an RF (Radio Frequency) signal, data is kept transmitted continuously like TV and radio broadcasting. In the receiver side, a tuner is synchronized with a characteristic frequency to receive the signal. Therefore, if other data than the signal exists in the frequency range, this data is received as normal data and causes noise. For example, in case of TV broadcasting, a ghost appears due to a reflected wave which is received after a delay.

25 In a technique which has already been established,
video and audio data is subjected to A/D conversion,
compressed according to MPEG, modulated in a method

of QPSK, QAM, or the like, and transmitted on an RF
signal. Therefore, the band range necessary for one
channel is small. In general, however, a plurality
of programs are transmitted within a band range of
5 one channel in order to maintain compatibility with
existing systems.

In this case, to receive a particular channel,
tuning is set to the frequency of the channel of a
program and data is demodulated. Thereafter, only
10 particular data is filtered from a plurality of
channels, based on an ID which the data has, and the
data is D/A-converted. Thus, a particular program
can be received and viewed/listened.

That is, as shown in FIG. 1, a plurality of
15 programs can be multiplexed on one same channel at
one same frequency, by adopting time-sharing in
which multiplex is made in the time axis direction.

However, it is impossible to know the timing when
the data to be received is transmitted, even tuning is
20 set to a target frequency. Therefore, it is necessary
to keep continuously receiving data, so that even
a signal delayed due to reflection or so is received
and causes a factor of deterioration of receiving
performance.

25 BRIEF SUMMARY OF THE INVENTION

An object of the present invention is to provide
a communication system in which the data transmitting

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5 Accordingly, it is possible to remove a problem of
noise caused by receiving data other than a target
signal, as normal data. Unlike a conventional system,
program data need not be A/D-converted to discriminate
ID (Identification Data) attached to program data
0 in order to extract particular program data from
a plurality of programs, so the processing steps are
simplified.

Another communication system according to the present invention comprises: a first transmitting/receiving apparatus for transmitting multiplexed program data to be transmitted from the first transmitting/receiving apparatus to a second transmitting/receiving apparatus, first transfer schedule table information indicating a schedule of the program data, and second transfer schedule table information concerning data to be transmitted from the second transmitting/receiving apparatus to the first transmitting/receiving apparatus, to filter means; the second transmitting/receiving apparatus for transmitting data to the first transmitting/receiving apparatus, based on the second transfer schedule table information transmitted from the first

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Additional objects and advantages of the invention will be set forth in the description which follows, and

in part will be obvious from the description, or may be learned by practice of the invention. The objects and advantages of the invention may be realized and obtained by means of the instrumentalities and combinations particularly pointed out hereinafter.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate presently preferred embodiments of the invention, and together with the general description given above and the detailed description of the preferred embodiments given below, serve to explain the principles of the invention.

FIG. 1 is a view showing a state where a plurality of programs are compressed into one channel and transferred.

FIG. 2 is a block diagram showing a video server system as an embodiment of a communication system according to the present invention.

FIG. 3 is a block diagram showing details of a video server shown in FIG. 2.

FIG. 4 is a view showing an example of a transmission schedule table.

FIG. 5 is a block diagram showing details of a filter unit shown in FIG. 2.

FIG. 6 is a block diagram showing details of a client shown in FIG. 2.

FIG. 8 is a view showing an example of
5 a transmission schedule table after filtering
the transmission schedule table shown in FIG. 4.

10 FIG. 10 is a view illustrating data flowing
between a server, a filter, and a client in the second
embodiment.

15 FIG. 12 is a detailed block diagram showing the
filter shown in FIG. 9.

FIGS. 14A to 14C are views showing an operation
20 example of a filter in case where only one frequency is
used.

25 FIG. 16 is a view illustrating an example of time
slots.

DETAILED DESCRIPTION OF THE INVENTION

In the following, embodiments of a communication system according to the present invention will be explained with reference to the drawings.

5 FIG. 2 is a block diagram showing a video server system as an embodiment of the communication system according to the present invention. As shown in the figure, the video server 1 which functions as a head end is connected with filter units 3 through
10 transmission lines 2 constructed by RF cables, CATV networks, or the like. Each filter unit 3 is connected with a plurality of clients 6 through upstream transmission lines 5 and downstream transmission lines 4. To simplify this figure, only two filter units are
15 shown although any given number of filter units can be connected. Also, any given number of clients can be connected to each filter unit. Between the video server 1 and each filter unit 3, data can be transmitted in one single direction, i.e., in the
20 direction from the side of the video server 1 to the side of the filter units 3. Meanwhile, bi-directional transmission is possible between each filter unit and each client. The communication networks between the video server 1 and the filter units may be symmetrical
25 communication networks (e.g., LAN (Local Area Network) or the like) or may have an asymmetrical structure. In case of an asymmetrical structure, the frequency

band of the downstream transmission line may be enlarged while the frequency band of the upstream transmission line may be reduced. Otherwise, the downstream transmission line may be constructed by an RF network while the upstream transmission line may be constructed by a telephone line network. Otherwise, the communication networks may be asymmetrical like a LAN and a telephone line network, or a wireless network and a LAN, etc. Also, each client may be constructed by a personal computer connected to a set-top box or a network through Ethernet or the like.

The video server 1 sends, in addition to program data to be transmitted essentially, a schedule table for transmitting program data for controlling the filter units 3, to the filter units 3 through the transmission lines 2. Also, the clients 6 send program information which they are currently receiving, to the filter units 3 through the upstream transmission lines 5. The filter units 3 perform filtering operation while changing its characteristics, based on the schedule table supplied from the video server 1 and the program information supplied from the clients 6. The video server 1 further transfers program data after the filtering operation, to the clients 6.

FIG. 3 is a detailed block diagram showing the video server 1 shown in FIG. 2. In this figure, the video server 1 is comprised of a CPU 11 which controls

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converter 35 for analog-to-digital-converting the transmission schedule table 13 received through the reception I/F 32 and the filter circuit 33.

FIG. 6 is a detailed block diagram showing the client 6 shown in FIG. 2. As shown in this figure, the client 6 is comprised of a reception interface (I/F) 61 for receiving program data transmitted from a filter unit 3, a tuner circuit 62 for making synchronization with the band frequency of program data received through the reception I/F 61, a selector circuit 63 for distributing received program data to an A/D converter circuit 64 or an image/audio output device 66 depending on whether or not the received program data is compressed, the analog-to-digital (A/D) converter circuit 64 for analog-to-digital-converting compressed data distributed by the selector circuit 63, a CPU 67 for controlling the entire client 6 and expanding compressed data subjected to digital conversion by the A/D converter 64, a D/A converter 65 for digital-to-analog-converting program data expanded by the CPU 67, an image/audio output device 66 for outputting program data outputted from the D/A converter 65 further to the outside, and a transmission interface (I/F) 68 for transmitting information concerning a program which any of the clients 6 currently receives.

In the following, operation of the communication system according to the present invention constructed

as described above. The video server 1 sends a plurality of program data items multiplexed by the frequency and time to the filter units 3. Each filter unit 3 receives the plurality of program data items transmitted from the video server 1 through the reception I/F 32, and transmits them to the clients 6 through the transmission I/F 34. Each client 6 outputs the plurality of program data items transmitted from the filter units 3 to an external device such as a monitor or the like through the reception I/F 61, the tuner circuit 62, the selector circuit 63, and the image/audio output device 66.

Next, the video server 1 prepares a transmission schedule table as shown in FIG. 4, in correspondence with data to be transmitted, and sends it to each filter unit 3 through the transmission I/F 16 and a transmission line 2. Each filter unit 3 receives the transmission schedule table 13 through the reception I/F 32. The received transmission schedule table 13 is supplied to the A/D converter 35 through the filter circuit 33 so that analog data is converted into digital data. The converted digital transmission schedule table 13 is taken in by the CPU 31.

Meanwhile, the CPU 67 of the client 6 transmits program information which the client 6 itself is currently receiving, to the filter unit 3 through the transmission I/F 68. The filter unit 3 receives this

program information through the reception I/F 37 and takes it in into the CPU 31.

Next, the video server 1 transmits program data multiplexed by the frequency and time. Each filter unit 3 takes in the multiplexed program data through the reception I/F 32. The CPU 31 controls the characteristic of the filter circuit 33 on the basis of the transmission schedule table and the program information transmitted from the client 6 such that target program information is extracted. The filter circuit 33 filters the program data supplied from the reception I/F on the basis of the filtering characteristic controlled by the CPU 31. Therefore, in case of program data like the channel 3 shown in FIG. 4 which is not multiplexed by the frequency, for example, only the data of the program 3 passes through the filter as a result of filtering, as shown in FIG. 7, and the other data is interrupted. In case of program data like the channel 1 shown in FIG. 4, for example, only the program 2 passes as shown in FIG. 8, and the other program data is interrupted.

Next, the second embodiment of the present invention will be explained.

FIG. 9 is a block diagram showing the second embodiment of the communication system according to the present invention. As shown in this figure, the video server 106 and the filter units 103, as well as the

filter units 103 and the clients 106, are connected to each other by RF cables 104 represented by coaxial cables for CATV, so that bi-directional data transfer can be achieved. Each of the video server 101 and the clients 106 has a transmission/reception function. The clients 106 transfer data to the server 101 with use of the same RF cables 104.

In the present embodiment, data which flows from the server 101 to the clients 106 is called downstream data, and data which reversely flows from the clients 106 to the server 101 is called upstream data.

FIG. 10 shows the flow of data between the server 101, a filter 103, and a client 106. As shown in this figure, downstream data 111, a downstream data schedule 113, and an upstream data schedule 115 are transmitted from the server 101 to the filter 103. The downstream data 111 is Internet data or the like for program data and clients. In the present embodiment, all programs and data for clients are multiplexed by the frequency and time. The downstream data schedule 113 is to specify the contents of downstream data by the frequency and time. Further, the upstream data schedule data 115 indicates a table showing upstream data transmission timings assigned to respective clients 106.

Also, downstream data 117 required by the client 106 and upstream data schedule 119 are transmitted from

the filter 103 to the client 106. The downstream data 117 required by the client 106 indicates data obtained by allowing only the data selected by each client 106 to pass.

5 Also, data transmitted from the client 106 to the filter 103 are downstream data filtering information 121 and upstream data 123. The downstream data filtering information 121 is information concerning programs is to be received from now and necessary data, which are used for filtering downstream data. For example, if the client 106 is a normal TV apparatus, the downstream data filtering information 121 is information indicating which channel has been selected. Also, the upstream data 123 indicates upstream data transmitted from each client, based on the upstream schedule.

15 Also, upstream data 123 is transmitted from the filter 103 to the server 101. When upstream data does not flow, the filter 103 executes filtering in accordance with a schedule for upstream data, which is supplied from the server 101, so that noise or unnecessary signals might not flow in the direction from the client 106 to the server 101.

20 FIG. 11 is a detailed block diagram of the server 101. The same parts as those of the first embodiment will be denoted at the same reference symbols as those of the first embodiment, and explanation thereof will

be omitted herefrom. Upstream data is received by the reception I/F 19 and is outputted, as digital data separated by the tuner 18, to the external device I/F 14. If upstream data is destined to the server 101, the upstream data is used within the server 101.

FIG. 12 is a detailed block diagram showing the filter 103. The same parts as those of the first embodiment will be denoted at the same reference as those of the first embodiment, and detailed explanation thereof will be omitted herefrom. As shown in this figure, the filter 103 includes a filter 309 for upstream data, a reception I/F 308, and a transmission I/F 310, in addition to components forming the structure of the filter according to the first embodiment shown in FIG. 5. The upstream filter 309 is controlled so as to carry out data reception in the same procedure as that of the schedule for downstream data. Information for filtering downstream data is not received through an RF cable but is received through another telephone line or LAN by the reception I/F 308 and is supplied to the CPU 31. Based on this filtering information and schedule data, the CPU 31 executes filtering on downstream data.

FIG. 13 is a detailed block diagram showing another structure of the filter 103. In this case, an RF cable is used for information concerning filtering of downstream data, like the case of upstream data.

Filtering information is extracted from data from the client 106 and is taken in by the CPU 311 through a reception I/F 317, a filter 319, and an A/D converter 315. Based on the filtering information, the filter 313 for downstream data is controlled.

FIGS. 14A to 14C show a schedule where one frequency is used and a state of filtering of upstream data based on the schedule. The numbers assigned to clients and filters are the same as those shown in FIG. 8. FIG. 14A is an example of a time schedule in the upstream direction, using one frequency. The numbers in the schedule are times assigned to respective clients 106. FIG. 14B shows an operation example of the filter 0. FIG. 14 C shows an operation example of the filter 1. In both examples, ON means that data is allowed to pass, and OFF means that data is interrupted. As shown in these figures, interference is avoided between different filters so that alteration of data can be avoided. However, for example, if an influence from noise, reflection, or the like caused by the client 00 overlaps the timing when a signal outputted from the client 01, destruction of data of the client 01 cannot be avoided.

FIG. 15A shows operation of the filter 103 with respect to upstream data when two frequencies are used. FIG. 15A shows an example of a time schedule using two frequencies. Note that the numbers in the schedule.

FIG. 15B shows an operation example of the filter 0,
and FIG. 15C shows an operation example of the
filter 1. ON means that data is allowed to pass, and
5 OFF means that data is interrupted.

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5 a) Information (schedule data) at the time
slot 2, concerning times and frequencies assigned to
respective clients.

c) When downstream filtering information is transmitted through an RF cable 104, the clients
15 assigns times and frequencies for transmitting
filtering information to the filter, at the time
slot 2.

20 d) Data to be transmitted originally through
severs 101 to the Internet.

e) Filtering information of downstream data which
25 the clients desire to receive at the time slot 2.

Additional advantages and modifications will readily occur to those skilled in the art. Therefore,

